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Zoonotic parasitic diseases at human-animal interface: a comprehensive study at a Zoological Garden in Punjab, India

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Background: Parasitic diseases of public health concern at the wildlife-human interface are of particular importance in zoological gardens, especially humans (veterinarian and zoo-keepers) coming in close contact with the captive wild animals. With the increased contact, the risk posed by multi-host parasites for humans and wildlife populations increases and the chances of 'spill-over' and 'spill-back' infections become of utmost concern.

Methods & Materials: A two year long comprehensive study was carried out to assess the parasitic infections of the wild animals, kept at MC Zoological Park, Chhatbir, Punjab, India, by employing classical, molecular and serological parasitological techniques. The whole study involved the screening of 909 scat samples of animals for the assessment of gastrointestinal parasitism by using concentration and sedimentation techniques. Molecular and serological techniques were employed for the confirmation of zoonotic parasites involving: *Toxoascaris leonina* (in Asiatic lions), *Baylisascaris transfuga* (in Sloth bear), *Trichuris* species (in non-human primates) and *Toxoplasma gondii* (in captive wild felines), respectively.

Results: The scat samples screening revealed the gastrointestinal parasitic infection of 25.52% (95% CI = 23.08-27.97%) in captive wild animals. But, the most common zoonotic parasites encountered by classical parasitological techniques involved: *Toxocara canis* in hyena, *Baylisascaris transfuga* in bears, *Toxascaris leonina* in Asiatic lions, *Strongyloides fuelleborni* and *Trichuris* species infections in non-human pimates, *Spirometra* species in captive wild felids including jungle cat, leopard cat and leopards. The molecular assessment confirmed the presence of *Toxascaris leonina, Baylisascaris transfuga* and *Trichuris* species in non-human primates. Serological studies revealed presence of toxoplasmosis in Asiatic lions (2) and tigers (3).

Conclusion: The present study highlights the presence of zoonotic parasites in the zoological garden, which establishes the vulnerability of contracting the infection by humans at contact. Further, studies are warranted on human population (zoo-keepers and veterinarians) of the zoological garden for the assessment of parasitic invasion representing the 'spill-over' infection and possibility of the captive wild animals of contracting the infection from them (spill-back infections). Further study will accomplish the necessity to generate a clear picture of transmission of parasitism at human-animal interface in the zoological garden.

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An oral formulation of Amphotericin B for the treatment of visceral Leishmaniasis: f-Gr-AmB

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Background: The oral administration of Amphotericin B (AmB) has a major drawback of poor gastrointestinal solubility and permeability. The aim of this study was to investigate the potential of functionalized graphene as a nanocarrier to improve the oral efficacy of AmB. Antileishmanial activity was determined in vivo in hamsters to investigate its therapeutic use.

Methods & Materials: ***Animals and Parasites***

Male Syrian golden hamsters, *Mesocricetus auratus*, (45–50 g) were procured from the animal house facility of the Central Drug Research Institute (CDRI), Lucknow were used as an experimental model for raising leishmania infection to assess the *in vivo* antileishmanial activity. *L. donovani*, *LEM138* (MHOM/IN/00/DEVI) stationary stage promastigotes were used for *in vivo* work.

Results: The experimental observation from the preliminary data of in vivo experiments evoked a linear relationship in reduction of parasite burden to dosage of the novel formulation. The f-Gr-AmB administered orally at a dose 5 mg/kg and 10 mg/kg body weight for five days of treatment resulted in 72% and 89% respectively compared with control group that received PBS. Intra peritoneal administration of f-Gr-AmB at 5 mg/kg resulted in 91% parasite inhibition. Further, at the oral dose of 10 mg/kg, f-Gr-AmB has a significantly greater antileishmanial activity than 5 mg/kg Miltefosine, the only oral drug available for VL. Antileishmanial activity of single dose intrapetoneal treatment of Ambisome resulted in the 98% inhibition of spleen amastigote parasites, when it was administered at a dose of 5 mg/kg body weight. The antileishmanial activity of intraperitoneal f-Gr-AmB was superior to Miltefosine which has shown 78% inhibition in the splenic parasite burden, when it was given orally to hamster at a single dose of 5 mg/kg body weight.

Conclusion: These results suggest that amine modified graphene could facilitate the oral delivery of AmB.

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